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SCIENCE NEWS-LETTER

The Weekly Summary of Current Science

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NEW GEYSER NOW WORLD'S MIGHTIEST

Young, But Fed by Immemorial Buried Fires

(*See page* 205)

Vol. XIV *No. 391*

U. S. Submarine on Scientific Cruise

Geophysics

Using a submarine to weigh the earth's crust instead of to sink ships is the task about to be undertaken by the U. S. Navy Department, in co-operation with the Carnegie Institution of Washington. On Tuesday afternoon, October 2, there sailed from the Washington Navy Yard the submarine S-21, accompanied by two eagle boats, on one of the most novel cruises ever undertaken — a cruise reminiscent of Jules Verne or Conan Doyle.

The submarine is a floating gravity observatory. By means of an instrument invented by a Dutch scientist, Dr. F. A. Venning Meinesz, of the Geodetic Commission of Holland, measurements of the force of gravity can be made at sea for the first time. So important are these observations that Dr. Meinesz was invited to the United States by the Carnegie Institution. The Navy Department has now given him the use of the eagle boats and submarine for a period of several months. During this time they will cruise around the region of the Gulf of Mexico and the Caribbean Sea. Assisting Dr. Meinesz are Dr. Fred E. Wright, of the Carnegie Institution's Geophysical Laboratory, and Elmer Collins, of the Hydrographic Office of the Navy.

In order to know the exact shape of the earth, scientists must know the force of gravity, and the only way of measuring this is by accurately timing the swings of a pendulum. Such measurements have been made on land for many years, but since the largest part of the earth's surface is covered with ocean, it left a large unknown area. The motion of the ship made pendulum observations impossible at sea.

Dr. Meinesz decided to make use of a submerged submarine, which is much more steady than a ship on the surface. But his improved apparatus is so successful that he now believes it possible to use it on a ship on the surface in still water and with the engines stopped to prevent vibration. Instead of using a single pendulum, he uses three, arranged as two pairs. They all have the same period, but are swung somewhat out of step. Tiny mirrors attached to them reflect a beam of light back and forth as the pendulum moves. Unlike an ordinary gravity pendulum, however, the light goes from one pendulum to the one next to it and then back to a moving strip of photographic paper, on which a record is made as a wavy line. Though the motion of the ship affects each pendulum, and each would give a very irregular record if recorded separately, the combination of the two results in a record like that of a single, steady pendulum. The apparatus was tried on a Dutch submarine, in which two trips were made from Holland to Java, one by way of the Suez Canal, the other by way of Panama.

The importance of these observations is that they afford an indirect method of weighing blocks of the earth's crust, said Dr. William Bowie, of the U. S. Coast and Geodetic Survey. Then, if it is found that the weight under water is the same as that of the crust under the land, it means that the density of the block of the crust under the ocean is greater, and that this part of the earth is in what the geophysicist calls "isostatic equilibrium." This gives a better and more accurate idea of the exact figure of the earth, and so provides data of fundamental importance to students of the earth. The region in which the coming cruise will be made is one of several important ocean deeps, great submarine rifts in the earth's crust. As an ocean deep is a favorite place for the occurrence of earthquakes, more exact knowledge of their characteristics may prove of especial value.

Though this is the first time that this work has been done except on the Dutch submarine, Dr. Bowie hopes that it will eventually be performed by all the navies of the world. "There is plenty of room in the oceans," he said, "for everybody." He also advocates that the U. S. Navy continue the work in the future, even after the present project is completed, by permanently equipping a submarine with the apparatus. As the accuracy of the charts used by the Navy depends upon exact knowledge of the earth's figure, the work is of considerable practical value.

Science News-Letter, October 6, 1928

In This Issue—

Exploring Davy Jones' Locker, p. 204—*Yellowstone's* Newest wonder, p. 205—The *Scanning Disk*, p. 207—The *Cupboard* Not Yet Bare, p. 209—An Ice *Jumble*, p. 209—How Old Is *Man?* p. 209—Evolving Feet Foremost, p. 211—*Earthquake* where Hurricane Came from, p. 211—*Dengue Fever*, p. 211—A Wanton *Destroyer*, p. 211—Learning the Constellations, p. 213—Beating *Yellow Jack*, p. 217.

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All of the resources of Science Service, with its staff of scientific writers and correspondents in centers of research throughout the world, are utilized in the editing of this magazine.

Yellowstone Has Great New Geyser

Geophysics

By Frank Thone

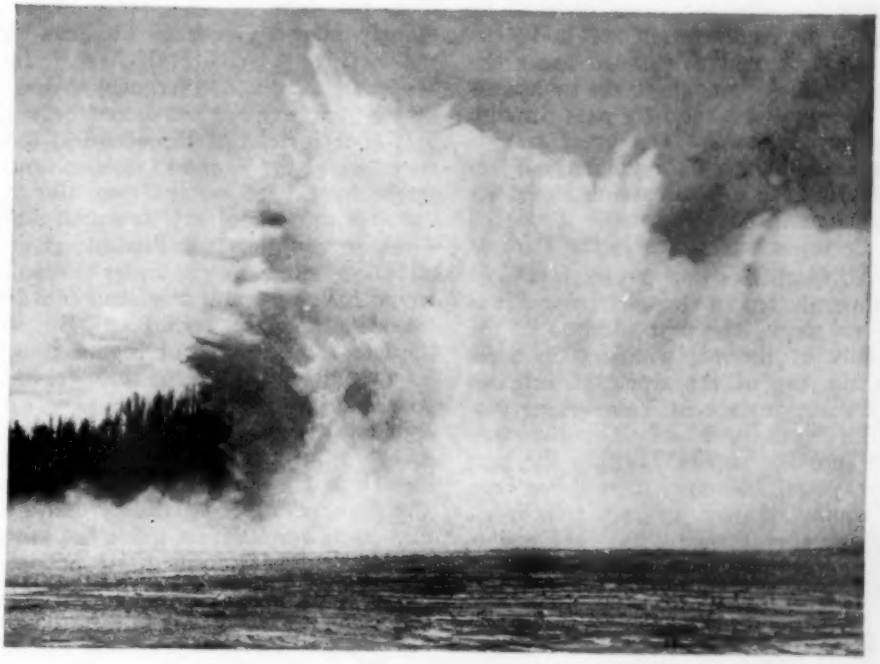
A tremendous new geyser, the hugest wonder of its kind in the world, has burst forth in Yellowstone National Park. Twice a day, with explosions like gunfire, it hurls into the air masses of hot water greater than are erupted by any other geyser now active. There has been nothing with which to compare it since the days of the old Excelsior Geyser, which blew itself to pieces in 1888 and has since lain as a simmering hot lake in the ragged chasm of its old crater. The new Titan, as yet unnamed, already bids fair to attract more attention from tourists than the Park's chief standby, Old Faithful, and it has made pygmies of the Giant and the Giantess, until now the biggest active geysers.

The new geyser has a crater of roughly circular form; about eight feet deep; its longest diameter is about 120 feet and its shortest 100 feet. It erupts twice in 24 hours, and each eruption lasts three hours or longer. Like most geysers, it does not play steadily like a firehose or a park fountain, but hurls its burden of hot water skyward in a series of spurts or jets. It throws these jets, frequently in all directions, at intervals of 15 to 20 seconds during its period of eruption, bursting forth from a quiet surface with a loud explosion and throwing a column of water to an average height of 60 to 75 feet, with occasional spurts of 100 feet.

The outlet through which the erupted water runs off is a gap four feet wide. Through this, during the entire period of each eruption, the hot water rushes in a stream eight inches deep at a speed of 120 feet per minute. Flowing at that rate through a three-hour period, this would represent, roughly, 450,000 gallons of water thrown out during each eruption. Assuming an initial temperature of 60 degrees Fahrenheit and an eruption temperature of 180 degrees (most of the geyser and hot spring waters are hotter than that), this mass of heated liquid would represent 432,000,000 British Thermal Units.

Assuming again a boiler efficiency of 25 per cent. (which is pretty high), it would require 67 tons of anthracite coal to heat that much water to such a temperature. And this geyser does that twice a day.

All this great volume of hot water that pours through the basin outlet comes from the geyser. There is nowhere else for it to come from. And the geyser does a thorough job; when it is through, it is through. It ceases its eruption suddenly, with an explosion as loud as the one it started with, and leaves the basin empty, except for a ten-foot fissure and a few bubbling mud springs on its north side.



OLD EXCELSIOR GEYSER, extinct since 1888, was the only peer that Yellowstone National Park's new phenomenon has ever known. (Photos by J. E. Haynes, St. Paul.)

The power of the geyser may be guessed at from a look at what it broke through to reach daylight. The outer edge of the crater shows a top layer of the hard, siliceous sinter which constitutes the surface rock throughout most of the geyser basins. Sinter is a stone like flint. It is, indeed, chemically very similar to flint, but differs in the mode of its formation. Sinter is deposited out of solution in geyser waters, usually very slowly. It is quite dense, and in a layer as thick as the one which surrounds the new crater it is exceedingly strong. Beneath the two-foot sinter layer is a stratum of black sand and hardened clay. The main orifice or fissure through wich the principal action of the eruption takes place is lined with sinter.

Scientists anxious to investigate the new geyser for once got their turn first, instead of having to wait until the news was broadcast and finding crowds of curious people ahead of them. This was due to a fortunate combination of circumstances. The department of geophysics of the Carnegie Institution of Washington, under the leadership of Dr. A. L. Day, has for several years been carrying on field investigations on the steam and hot-water phenomena of the Park in general. Dr. E. T. Allen has been in immediate charge of this work. Thus when the new geyser "broke," the best-informed minds on this continent were within a few miles of the spot, with equipment for immediate research.

A further fortunate circumstance was what might be called the "isolated accessibility" of the new geyser. It is near enough to the highway so that the exploring party could drive to within a couple of miles of it in automobiles, but still far enough away so that it could roar away day and night without attracting the attention of the casual traveler. It lies two miles due west of Excelsior geyser, and eight miles southwest of the Fountain ranger station, in the Fairy Creek region.

When Superintendent H. M. Albright was informed of the new outburst he wisely refrained from telling the world about it for a few days, until the scientific party could go in and complete their preliminary studies. Then, with infor- (*Turn to next page*)

Yellowstone Park Has Great New Geyser—*Continued*

mation in hand as to the real nature of the new monster, and with an estimate of how intimate an approach might be safe for large crowds, he visited the place himself and laid plans for a new road which will make the place easily accessible to the thousands of tourists who annually pass through the geyser basins. The great size of the new geyser, its regularity of action, and the explosive violence of its eruptions, promise to make it one of the greatest attractions in the Park.

Although this new geyser is almost unprecedented in size and power, it is by no means the first addition to the family of thermal wonders up there on the top of the world. Surprises are commonplace in Yellowstone National Park, and only the big ones get into the papers. Within the past few years, however, there have been a couple of new geysers which, although they turned out in the end to be but temporary ones, were nevertheless big enough to make page one in their time. Both of them most accommodatingly put in their appearance near the main highway—one of them, as a matter of fact, considerably too near it for comfort.

Early on an August morning in 1922, a solitary driver of a road sprinkler, performing his beneficial office on the highway near Roaring Mountain, received the scare of his life. What had always been a quiet, muddy, hot pool so obscure that it could hardly claim a name suddenly lifted itself a hundred feet or more into the air and came down upon the road with a thundering shower of water and mud and stones and waterlogged wood. For a part of the day traffic had to be held up on the road while a detour was laid down around the puddle that had suddenly become a geyser. The new spring erupted several times more during the next few days, killing trees for many yards and plastering everything thickly with mud. Then it became quiet again and has not erupted since.

The following year, during the visit of the late President Harding, another new geyser broke out in the Norris geyser basin. It also was a muddy spring of irregular eruptive period, and after the first few weeks its activity diminished to the point where it is now listed as "infrequent," and may really be extinct, except as a quietly running hot spring.

Geysers not only get born; they also die. The greatest geyser that has ever been seen by man, the old Excelsior geyser, nearest notable neighbor of Yellowstone's new giant, met such a fate. This monster among hot-water springs, which had a crater even huger than the new geyser's, was picturesquely known to earlier travelers in the Park as "Hell's Half Acre." Its eruptions were not so frequent as those of the new geyser, and lasted only a half-hour instead of three hours; but they were even more violent, and threw masses of water from 100 to 200 feet into the air. It is stated that after an eruption the Firehole river, on whose left bank the crater yawned, would have its water level temporarily raised as much as four feet. But in the late 1880's Excelsior began to excel even itself. Its eruptions became so explosive that they tore off great chunks of the flinty sinter that crusted it over, hurling the masses of rock high into the air. The geyser literally erupted itself to death, and today is no more than a great hot lake, seething at the bottom of its precipitous-sided pit.

There is, of course, no way of telling when a supposedly extinct geyser may burst forth into renewed activity. Beehive geyser, noted for its symmetrical dome-shaped little cone and the height to which it throws its slender column of water, was rated as extinct a few years ago, but to everybody's surprise and delight resumed activity. Economic geyser, so called because it caught every drop it erupted in its wide basin and used it over again, has not played for years, but the rangers still watch it hopefully for possible signs of life. Mud Volcano, which is really a great boiling mud spring, has had a couple of violent eruptive periods, during which it blocked the Hayden valley road. The last of these was nearly thirty years ago; but that this awesomely ugly natural howitzer will never let loose another blast is too much to prophesy.

Every once in a while a chunk of the soft chalky travertine terraces at Mammoth Hot Springs gets too heavy for its perch on the steep hillside, and slumps off. An especially large slide of this kind occurred about five years ago, spilling the road to overflowing with what looked like extra soft white finishing plaster. The report got out that the terraces had exploded and were setting up in business as geysers. As a matter of fact, Mammoth Hot Springs is the one place in Yellowstone Park where there can not be a geyser. The mineral deposited out of the hot waters at this place is not silica but calcium carbonate, chemically identical with limestone but here forming a much softer rock, not strong enough to stand up under the explosive steam action required for a real geyser eruption.

For true geyser action, such as is found in the geyser basins of Yellowstone National Park, three things are necessary. First, a supply of heat. This comes from steam released by deeply buried masses of lava. Nobody knows how far down the lava masses that are Yellowstone's furnaces may lie; perhaps a mile, perhaps less. At any rate, they are so thickly blanketed under layers of earth and rock that they have never cooled, though ages have elapsed since they were first forced into their present position.

The second thing a geyser needs is a tube or vent through which the eruptions can take place. This may be simply a crack in the rock or it may be a tube that the geyser has formed for itself out of sinter. The tube may be either crooked or straight; it may be either simple or branched or equipped with outpocketings on its sides. No two geysers are quite alike in these respects, hence no two of them erupt in quite the same manner or at quite the same time-intervals.

The third requisite for a geyser is a supply of water. This does not come, as was once widely believed, from deep subterranean sources, but is surface water, from rain or melted snow. It is because of this fact that geysers are almost without exception located in valleys, not far from streams or lakes. The water finds its way into the tube, either through the top, or more frequently through underground opening into the sides. The tube becomes filled, and the steam, rising from the lavas far beneath, heats the water up. The lower part of the water column is finally hotter than boiling point, but because of the pressure of the water above, it can not evaporate into steam. At last, however, a little of it spills over, or a bubble of steam lifts a few gallons over the rim. That takes off some of the pressure at the bottom of the tube, and part of the overheated water flashes at once into steam. The steam lifts out a still greater mass of water, the pressure is still further reduced, a huge volume of steam leaps into being and with an irresistible upward surge the newly released power of a thousand giants hurls the water out of the tube in a roaring eruption.

Science News-Letter, October 6, 1928

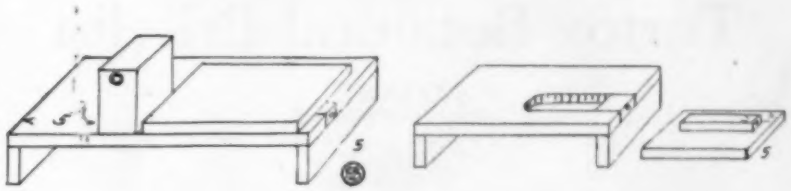
The Chinese use the color red to symbolize happiness or good luck.

How to Make Your Radiovisor

Radiovision

By C. Francis Jenkins

This is the fourth in a series of articles prepared for Science Service by C. Francis Jenkins, radiovision pioneer inventor. Copies of the issues of the Science News-Letter containing the previous articles may be obtained from Science Service for 15 cents each.



The pieces of the radiovisor frame made according to the directions in the previous article are now ready to assemble.

Under the ends of piece A, the base board, nail the two pieces C, the 8-inch strips; and in the slot of piece A, flush with the end, glue or otherwise fasten piece E. See the illustration. On the bottom of piece B, the motor board, screw the 6-inch piece D, equi-spaced endwise, 2 inches from the far edge with the holes to the right. See the illustration. Then assemble the two by putting the strip on the motor board into the slot in the base board.

Now fasten the scanning-disc shaft-bearing block piece F, with an end flush with the long edge of the base-board and parallel to and 5 inches from the end of the board, with two screws up through the base-board into the block. A hand drill will help a lot. See the illustrations for all these details.

A cast-brass or cast-iron shaft bearing may be substituted for the brass bushed wooden block if one can be found or made.

Now that the frame is made and assembled, the scanning disc can be made.

Some will wish to save time and work by purchasing the scanning disc ready made, but by carefully following these directions it can be made satisfactorily.

For the scanning-disc, cut a 12-inch diameter disc out of almost any thin material, like sheet iron, "tin," brass, aluminum, millboard, cardboard, or even heavy paper. The best result will be attained by first putting a 5/16-inch hole in the center of a roughly-cut-out disc, mounting it on the shaft on which it is finally to be used, then turning it slowly while holding a knife-blade, or other sharp tool, against the disc six inches from the center of the shaft. With the point held steady on a block or the like, a scratch can be made on the disc which is a true circle, about 12 inches in diameter. A sharp pencil will do to mark paper or cardboard, of course.

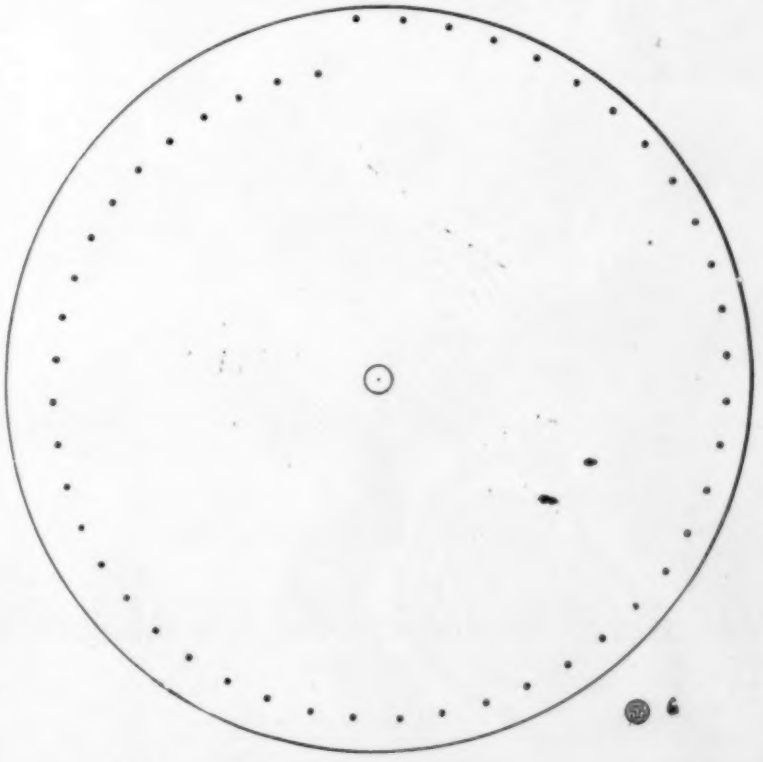
With tinner's snips, if metal, or scissors, if cardboard or paper is used, a disc will be cut out along this circular scratch. But before doing this, divide the circle into 48 equal spaces. With a pair of dividers this can be sufficiently accurately done although it is tedious, and takes time to do well. Take the disc off the shaft to lay out these 48 dots on the circular scratch. The 48 spaces will be a little less than ¾-inch separated. Next draw radial lines from the center of the disc to each of the 48 equi-spaced dots on the circle.

Now put the disc back on the shaft, held tightly thereon with the nuts, and tie on the outer end of the shaft a shoe-maker's thread, a fish-line, or similar string not easily stretched. Wrap the string around the shaft a few times so it will "stay put." Into a loop at the other end of the thread put a pencil or scratcher held steady, perpendicular to, and touching the disc near the bottom edge. By turning the disc a spiral line is drawn on the disc because the thread wraps up on the shaft, shortening it as the disc is rotated. The spiral should begin about ¼-inch from the edge and make a complete turn. The beginning and the end of the spiral will be a little less than ¾-inch apart.

Where this spiral line crosses the radial lines is where the 48 scanning holes are to be drilled if the disc is metal, or punched if the disc is paper.

The spirally located scanning holes should be about 1/32 of an inch in diameter. Theoretically this is too large, but it will give a brighter picture, and like the method of laying off the scanning disc spiral, is not sufficiently wrong to be noticeable.

If you are using a paper disc, you can punch the holes by breaking a needle in two and use as a punch, on the sawed off end of a block of wood. The pieces punch (*Turn to next page*)



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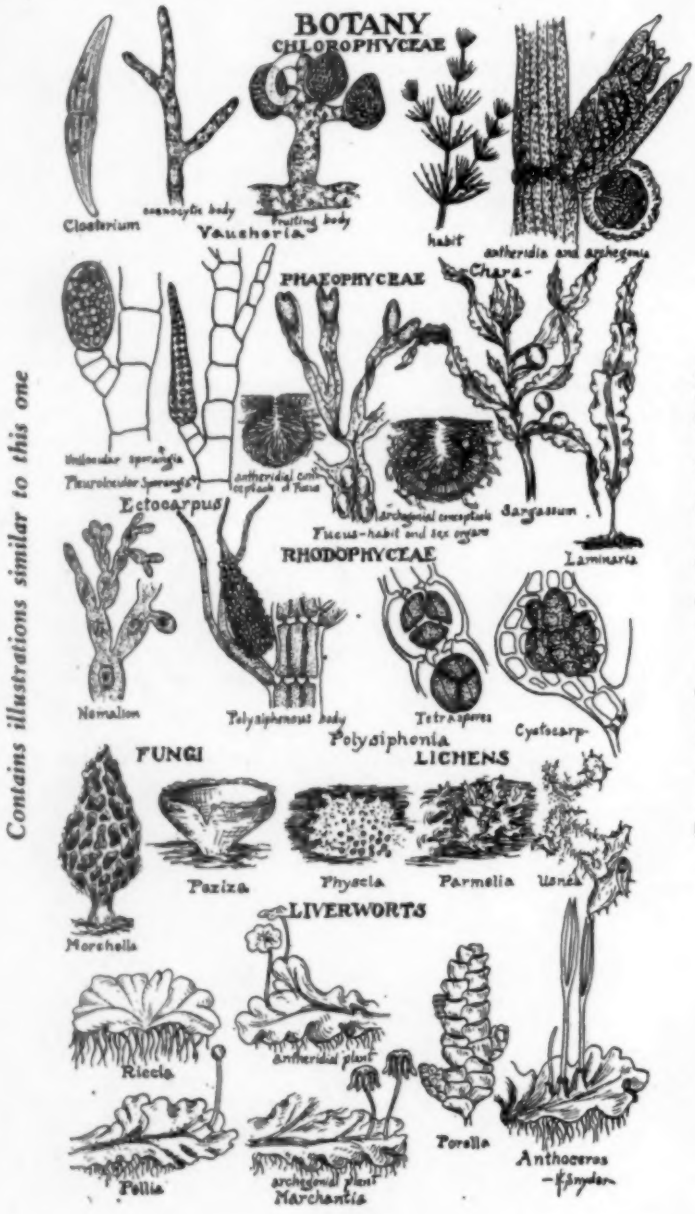

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Radiovision—*Continued*

out, leaving a clean hole, if the punching is done in the end of the block against the grain of the wood.

With the scanning disc back on the shaft, mount the neon lamp close behind the disc at the top. A very convenient lamp holder can be made of a piece of wire wrapped about three times around the end of a broomstick with a separation that fits the threads in the screw base of the lamp. Push the straight portion of the wire into a hole in the shaft-bearing block, and bend the wire so that the spiral holder stands up like a Christmas candle holder.

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Alcohol and Bitumen Sands for Power

Engineering

Following are reports of some of the leading papers presented at the recent meeting of the World Power Conference at London.

Britain's never-setting sun will be called upon to furnish fuel for power and transportation when the world's oil supplies run low, Colonel Sir Frederick Nathan, well-known English ordnance expert, told the World Power Conference in London. Alcohol, though now too costly as compared with oil fuels, stands ready to come to the rescue when the latter send up distress signals in the form of relatively small advances in price.

In fact, alcohol is already a source of power in many countries of Europe, where it is marketed for the most part as a mixture with gasoline or benzol. In Germany the power alcohol consumption as long ago as 1903 went over the million-gallon mark, and now the sale of "Monopolin," a mixed fuel which is a State monopoly, calls for the production of over 3,000,000 gallons of fuel alcohol a year.

Fuel alcohol is a commercial success in Germany, Sir Frederick explained, because its production is based on the German potato crop, which has been especially fostered for many years. Between 5 and 6 per cent. of all German potatoes go into alcohol. In Britain alcohol can not be produced economically from home grown crops; but the colonies and commonwealths within the Empire are in better position to supply starch and sugar materials for conversion into alcohol. The tropical and semi-tropical lands under the British flag are especially well adapted for such production.

But there may be a long day to wait before all the oil resources of the British Empire are exhausted. K. A. Clark, Canadian fuel geologist, reported on the existence of a vast bed of bituminous sand in Alberta, which may be exploited when the easily skimmed cream of the oil wells has been used up. The deposit lies along the Athabaska River in the northern, unsettled part of the province, the southern edge of the area being 300 miles north of Edmonton. The formation varies from 100 to 200 feet in thickness, and is known to exist throughout an area of from 750 to 1,000 square miles. It lies very close to the surface, in most places less than 100 feet below ground level. Various "cracking" processes are reported to be fairly successful in getting a useable oil out of the bitumen content.

Diesel engines, using heavy oils, are now in successful use on Russian railways, according to F. Yanchouschevsky, Russian engineer, who spoke before the conference. Three locomotives of this new type, two of them built in Germany and the other in Russia, have been in experimental use on the Moscow-Baku trunk line, and the results are held to justify further construction.

The locomotives (*Turn to next page*)

Alaskan "Ice Jumble"

Geography

A strange "near-glacier" of mammoth proportions was discovered in Alaska this summer during the expedition of the National Geographic Society to study volcanoes along the Alaskan peninsula, according to C. P. McKinley of the U. S. Geological Survey, who has just returned to Washington. The expedition was led by Dr. Thomas A. Jaggar, director of the Hawaiian Volcano Laboratory.

For lack of a better name, Dr. Jaggar termed the near-glacier an "ice-jumble," since he never before had seen anything like the peculiar geological formation. He expressed the belief that it is the result of the continuous dumping of volcano ash into the area for hundreds of years. The materials consist, Mr. McKinley explains, of ice, gravel boulders, pumice, ash and sand in a vast hummocky sea. Four streams flow from the front of this near-glacier in virtually the same fashion as from an actual glacier. Nearby and above, the mighty Pavlof volcano fumes constantly from its symmetrical cone, a veritable American Fujiyama.

Another natural phenomenon witnessed by the scientists at close range for probably the first time in history was the (*Turn to next page*)

Man's Antiquity in America Debated

Anthropology

That the American continent has been inhabited by men at least twenty thousand years, judging by important evidence unearthed at Folsom, New Mexico, is the claim of Barnum Brown, of the American Museum of Natural History.

Sixteen stone arrow points found buried with the bones of thirty extinct bison are the evidence of a prehistoric buffalo hunt which Mr. Brown said demonstrates the antiquity of man on this continent. The oldest Americans whose skeletons and possessions have been found are the basket-maker Indians, who date back perhaps to 2000 B. C. But the search for older Americans than these has been vigorously pursued. In about forty instances, bones of ancient animals have been found with human weapons, but whether the bones and weapons were really of the same age has been debated to no conclusion.

Mr. Brown, who has just returned from examining the scene of the buffalo hunt, said that he dug out one of the arrows himself. The layers of earth in which the bones have become buried and other geologic features of the site indicate the great age of the deposit, he said. The Colorado Museum of Natural History first examined the remarkable site. Now, the American Museum of Natural History is cooperating in the study of the region.

The arrow points are of strangely fine workmanship, rivaling the weapons of Stone Age Egyptians.

The antiquity of these cleverly made weapons is questioned by Dr. Ales Hrdlicka, of the Smithsonian Institution.

Dr. Hrdlicka states that there are five weaknesses in the evidence which argue against the high antiquity of the finds. The Indians rarely killed game in large quantities, and after a killing the parts of an animal were economically made use of, including the bones. The skillfully made weapons, he believes, could not be very ancient. Dr. Hrdlicka's interpretation of the scene is that the buffalo herd became mired there while trying to drink at the stream, and that the arrow points might have been thrown into the stream much later by Indians making religious offerings, and so have been washed into proximity with the bones. The evidence so far recovered is not sufficient, he declares, indisputably to prove man's geological antiquity on this continent.

World Power Conference—*Continued*

weigh 118, 131 and 182 tons, respectively, and are designed for freight hauling at relatively low speeds. One of them has electric transmission, while the other two are equipped with mechanical transmissions, operated through a specially designed magnetic clutch.

The advantages of heavy-oil engines in general, in view of the constantly increasing shortage of gasoline and other vaporizing oils, formed the theme of much of the discussion. Prof. M. Defays, a member of the Belgian delegation, stated that the cost of the fuel consumption in the heavy-oil types of engine as compared with that of gasoline is three to six times less, while in weight the consumption is reduced to 80 per cent. and even to 50 per cent. of that of gasoline. The fuel cost for locomotives, compared with that of coal, is noticeably less; in weight the consumption is at least six times less. For aviation, the saving in fuel cost compared with that of gasoline is very marked, while the fire danger is practically eliminated. Diesel engines for automobiles, Prof. Defays declared, can get along on a third or even a fiffth of the fuel required for the present gasoline-burning types.

"The struggle between the railway and the road will become more and more in favor of the road," he prophesied. "The result will be that in order to defend itself against the heavy oil engine the railway will have to adopt the same prime mover. The chief use of the railway will be for transporting heavy goods and passengers over considerable distances.

"Aviation will gain in security while the cost of air transport will be considerably decreased. Commercial aviation will be used more freely for the transport of passengers and mails as well as for merchandise."

The conference was not wholly occupied with questions of huge engines for railways and factories. Power for the housewife's work came in for its share of discussion. And the old kitchen range had to accept condemnation for extravagance as well as for discomfort. Dr. Margaret Fishenden declared that with gas or oil a meal can be cooked at one-fifth of the thermal consumption in the use of a coal stove, while the heat used in an electric range is only one-thirteenth that of coal.

Swedish frugality in the use of wood was related by Axel Härlin. Not only is every scrap used for the conventional wood purposes, but at the end even the shavings and sawdust find chemical employment. Investigations are now being carried out, he said, with a view to producing oil from waste wood, and the production of sugar from wood is now a definite technical possibility.

Science News-Letter, October 6, 1928

"Ice Jumble"—*Continued*

great group of pinnacle-formed peaks on the peninsula known as the Aquileen Pinnacles. Averaging 4,800 feet above sea level, they resemble a vast number of church spires.

The expedition's route lay from Squaw Harbor on Unga Island, in the Shumagin group, to Canoe Bay, head of Pavlof Bay on the Pacific side of the Alaska peninsula, then along the shore of the Pacific westward to King Cove. Besides Dr. Jaggar and Mr. McKinley, the personnel consisted of R. H. Stewart, photographer; John Gardner and Peter Yatchmeneff, field men, and a cook.

From a scientific standpoint, Mr. McKinley says, the expedition was a signal success. This was the second summer of the Society's four to five year survey, under Dr. Jaggar, of the greatest chain of volcanoes in the North American continent. The party scaled a newly found volcano peak in the northern part of the Alaska peninsula; collected data for a topographic map of 1,500 square miles of hitherto unknown territory; and assembled a wide variety of geological, botanical and biological specimens.

Being marooned on an island without food for four days; hiking across miles of rough country filled with volcano ash that was knee deep at times; and pulling horses out of almost impenetrable marshes, were a few of the unusual experiences that removed the daily routine from monotony.

Science News-Letter, October 6, 1928

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Did Man's Legs Outrun His Head?

Evolution

Has man gone up the evolutionary ladder literally feet first? Did his legs evolve into human legs faster than his head evolved into a human head?

The possibility that there has been a tendency in the human genus to evolve from the bottom up in more than the figurative sense is suggested by Dr. Wilhelm Gieseler of the University of Munich, writing in the German scientific weekly, *Forschungen und Fortschritte*.

Dr. Gieseler has made a study of the two most-disputed human or near-human remains so far discovered, the Pithecanthropus or Ape-Man of Java and the Broken Hill Man of South Africa. Both of these *n*-th degree great-uncles of the human race had very primitive skulls, the cranium of Pithecanthropus especially being so "low-brow" that many anatomists are still disposed to deny it human rank at all but to classify it instead as the skull of an extinct species of gibbon or East Indian ape.

The German investigator defends his opinion that Pithecanthropus was human, largely on the basis that his eye-sockets are man-like rather than ape-like, although he admits that the skull is so low that the doubts of some of his colleagues are easily accounted for.

But an examination of the thigh-bones of both Pithecanthropus and Broken Hill Man tells an entirely different story, according to Dr. Gieseler. Not only is the thigh-bone of Pithecanthropus quite unlike that of a gibbon, but the thigh-bones of both the extinct humans (or near-humans) are so much like those of modern man that doubts have been expressed in both instances as to whether they really belong with the skulls at all. If they do not, he argues, it is an extremely striking coincidence that *two* debatable skulls should have happened to be found with thigh-bones that did not belong with them. If they do, we have the astonishing spectacle of men, or man-like creatures, with very decidedly primitive skulls walking on leg-bones built on a decidedly modern pattern.

Science News-Letter, October 6, 1928

Quake at Storm's Birthplace

Seismology

The birthplace of the hurricane that recently devastated Porto Rico and parts of Florida, has again made itself known to the world—this time with an eartquake. A tremor occurred there at 7.44 p. m., Eastern Standard Time, on Wednesday, September 26. This announcement was made by the earthquake experts of the U. S. Coast and Geodetic Survey after the study of data gathered by Science Service.

A point about 250 miles off the mouth of the Orinoco River, on the northeast coast of South America, at 12 degrees north latitude and 59 degrees west longitude, was the center of the quake. It was in this same position that the Florida hurricane was first reported.

Another effect of the storm on the ground was shown recently when the hurricane moved up the Atlantic coast. Several days before it reached Washington, Rev. F. A. Tondorf, S. J., director of the earthquake observatory at Georgetown University, recorded a great number of micro-seisms, slight but continuous tremblings of the earth. This was a direct effect of the storm.

Science News-Letter, October 6, 1928

Mosquitoes and Dengue

Hygiene

Dengue fever, which has been running riot in Athens, and in fact has swept over the whole of Greece, is no respector of persons, having finally attacked Prime Minister Venizelos himself. The total number of cases in the present epidemic has reached 80,000, according to reports received by the U. S. Public Health Service in Washington. This is an unusually large number even for a warm country like Greece, where the disease occurs frequently.

Dengue fever, like yellow fever and malaria, is one of the so-called tropical diseases and is spread by the mosquito. In former times it was considered a mild form of yellow fever, but more recently it was found to be a distinct disease. It has a sudden onset, and the course of the disease is acute and short, usually seven days. The death rate is very low, the patients almost always recovering. The severe pains which characterize this fever earned it the name of "break-bone" fever.

One medical authority states that no disease, not even influenza, attacks so large a proportion of the population. The last epidemic to occur in the United States broke out in 1922.

Science News-Letter, October 6, 1928

Nature Ramblings

By Frank Thone

Natural History

A Wanton Destroyer

In a recent issue of the *Atlantic Monthly* there was a striking short poem by Dorothy Leonard; the disjointed death-agony thoughts of a sparrow impaled on a thorn by a shrike:

"The Great Shrike put me on a thorn
Too near the house where I was born.
It's made of straw I thought so fine.
I see that heaven-pointing pine
I sang in, scrag against the sky.
No singing now for such as I.
Poor I—he must have marked my crest
(Or that strange spot upon my breast)
To fancy me from all the rest.
Good Cankerworms! The tree's possessed!
These other hop-in-hedges loop
Their necks like robins with the roup.
Don't lollop around so sour and still,
Grimalkins . . . fly to Thirsty Hill!
I heard my blood drip on a stone.
Oh, Birds, how bright his bent beak shone!

The shrike, or butcher-bird, is often berated because of its apparent ferocious cruelty, in hanging grasshoppers, mice, small birds and other living things on thorns or barbed-wire fences and leaving them there in lingering agony. But it is not settled whether or not the bird takes any pleasure in the misery of its victims—whether its cruelty is cold and deliberate, or simply wanton and wasteful.

There is no doubt that basically it is nothing but a food-storing instinct. But the shrike kills so much more game than it eats, and forgets where half its stock is left hanging. That looks like sheer cruelty. Yet we reflect that California woodpeckers lay up far too many acorns, that bees store much too great a treasure of honey, that dogs (*Turn to next page*)

Wanton Destroyer—*Cont'd*

bury bones and guard them jealously though they may never dig them up again, and that proud and self-conceited Man himself slaughters twenty wild geese when he can't eat the whole of one, or breaks a dozen business rivals in the accumulation of a fortune of which he can't spend a tenth. Is the shrike alone in his wasteful madness?

Science News-Letter, October 6, 1928

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by Frederick Barry

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Invention of Pottery

Anthropology

RICHARD SWANN LULL in *Ancient Man* (Doubleday, Doran):

Pottery is so distinctive a feature of human culture that a brief summary of its development during Neolithic time seems needful. Just how it originated is an interesting question. It is evident, however, that some means of storing liquids arose with permanency of habitation and the necessity of provision against a time of scarcity. It may well be that the art of making pottery originated somewhat accidentally through the effort to render watertight certain plaited containers, in other words, baskets, by plastering the inside with clay, and there is evidence that that very thing was done. If these were used near the fire or in connection with the operation of cooking, some of the clay would be hardened by the action of fire, and thus another step in the operation discovered, for sun-dried vessels can be made permanent only in a tropical climate. The art of the potter has evidently been repeatedly acquired by mankind as a local discovery, hence one may not say that it had its origin with this or that ancient people and thence spread over the world. And as the Australians and other races of today are yet in Stone Age stage of cultural evolution, so one may find certain primitive peoples still making pottery in the crudest imaginable way and thus recapitulating the evolution of the art as it developed in Neolithic Europe.

Three methods of pottery making seem to be common to all primitive peoples. They are:

1. Hollowing out a vessel from a lump of clay.

2. Building up on some support such as basketwork or a plaited mat, and adding masses of clay to increase the capacity of the vessel.

3. Coiling, wherein a mass of clay is rolled out in the form of a rope, the object built up spirally, and then smoothed either by the hand or by simple wood or bone instruments.

The invention of the potter's wheel, again an instrument independently acquired by diverse peoples, came much later, not until the Age of Bronze.

Science News-Letter, October 6, 1928

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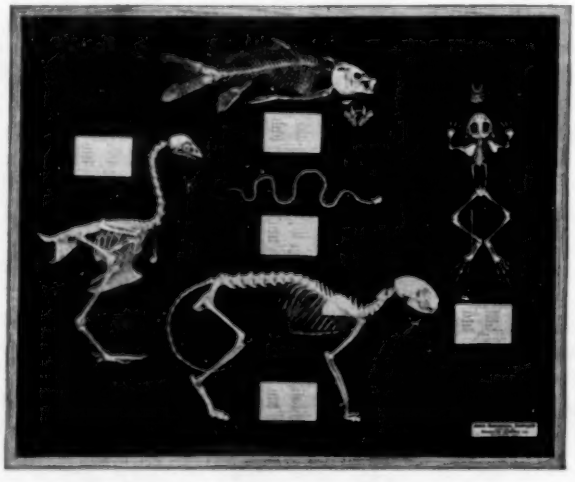

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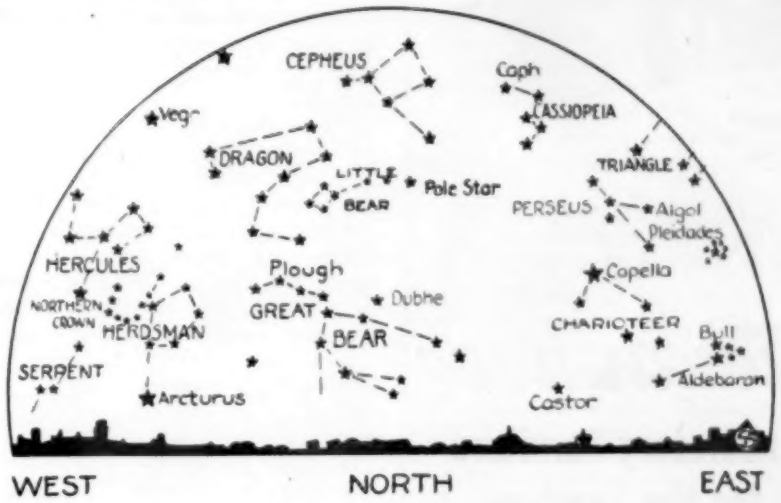
Begin Constellation Study Now

Astronomy

By James Stokley

If you do not already know the stars and constellations, October is a good time to begin to learn them. High in the southern sky is the "Great Square of Pegasus," four stars of approximately equal brightness, which form the corners of quite a perfect square. Actually, only three of them are in the constellation of Pegasus—the one towards the northeast is in the neighboring constellation of Andromeda. Pegasus, the winged horse, extends westward from the square, while Andromeda, the chained lady, is to the northeast. So when you identify the square, you already have two constellations added to your repertoire.

Now follow along the curved row of stars in Andromeda—after three bright ones you come to Perseus. North of Andromeda is the W-shaped group, now on its side, of Cassiopeia, the Queen in her chair. To the east of her is Cepheus, the King. Southwest of Cepheus is Cygnus, the swan, or, as it is sometimes known, the "Northern Cross." Deneb is the bright star that marks the top of the cross. East of Deneb is the brilliant Vega, which marks the constellation of the lyre, Lyra; while south of Vega is the brilliant Altair, in Aquila, the eagle. The bright star low in the south, almost on a line with the eastern side of the square, is Fomalhaut, in Piscis Austrinus, the southern fish. Fomalhaut is the most southerly of all the first magnitude stars that we see in these latitudes. Between Pegasus and Piscis Austrinus is Aquarius, the water-carrier. In the old star maps he is represented as emptying a jug of water, which flows into the mouth of the southern fish! To the southeast of Pegasus; that is, the square, are the fishes, Pisces, which are neither drinking nor swimming but are represented as two fishes tied together. These are some of the principal constellations of the October evening sky—all of them, and others, are shown on the maps.

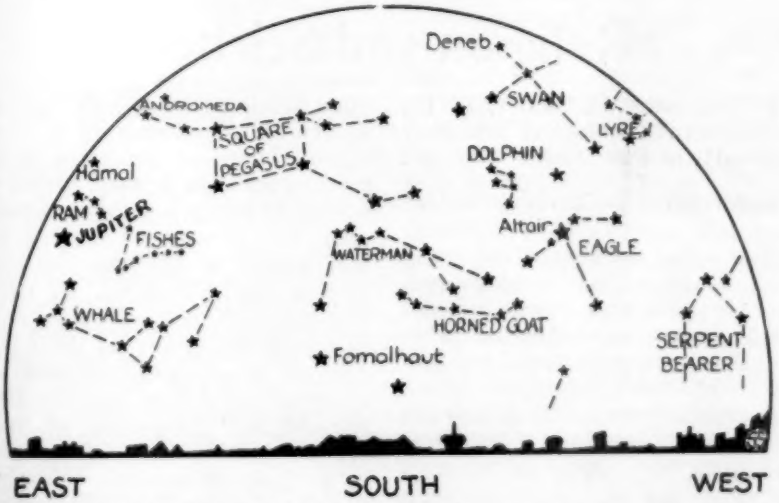


To the ancients, these constellations had particular significance, associated with the origin of their names. The names are mostly ones that have no apparent connection with the arrangement of the stars. Even when we look at some of the old star maps and see how a winged horse was drawn around tne stars in Pegasus, or a bear around those of the Great Dipper, it does not become any clearer. In fact, one might with just as much reason draw any of a variety of things around the square of Pegasus and the other stars in the constellation.

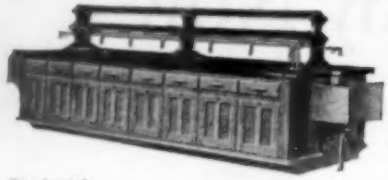
Only the front half of the horse is represented and, strange to say, he is inverted. This might suggest that the constellation name originated in the southern hemisphere, where the horse would appear right side up, but there does not seem to be any historical justification for this idea. The four rather faint stars extending southwestwards from the corner of the square form the horse's head and neck, the group from the corner towards Cygnus his forefeet, and the southeastern corner his wings.

In the ancient Græco-Roman mythology, Cepheus, Cassiopeia, Perseus, Andromeda and Pegasus are all connected. Cassiopeia was the queen of Ethiopia and Cepheus the king. They were the parents of Andromeda. Cassiopeia was a lady of wondrous beauty. Realizing this, she once boasted that she was fairer than Juno, the wife of Jupiter, or the Nereids, the sea nymphs. This angered the sea ladies, so they complained to Neptune, who sent a sea monster to the coast of her country for her insolence. Jupiter placed her in the sky in such a position that for half the year she hangs head downwards, adding to her shame.

As a further punishment and to appease Neptune's wrath, she was required to sacrifice her daughter to him, so Andromeda was chained to a rock on the Ethiopian coast to await the coming of the sea monster to devour her. Cetus, the whale, a constellation now below Andromeda in the southeast, represents the monster. But she was finally rescued by the great hero, Perseus. Having slain the Medusa, whose beholders were turned to stone, and riding on his steed Pegasus, he showed the Me- (*Turn to next page*)



HOLD THESE MAPS IN FRONT OF YOU. The upper then shows you the northern and the lower the southern sky as it appears on October evenings



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October Star Story—*Continued*

dusa's head to the sea monster, who was turned to stone also, and thus he rescued Andromeda. He had slain the Medusa, as is well known, by the device of watching her reflection in his polished shield.

With these figures so well known, and dating from such remote antiquity, it seems surprising that anyone has ever tried to supplant them. But about the sixteenth or seventeenth centuries there were several new schemes proposed by which a Christian mythology was introduced into the heavens, and the stars associated with Biblical characters and objects. One such system, devised by a pious astronomer, named Schickardus, kept the old names and attached Christian significance to them. He made the figure of Perseus with the Medusa's head into David holding the head of Goliath, a very slight change. Aries remained a ram, but became the ram that Abraham offered in sacrifice for Isaac.

But evidently this was not sufficient, so along came another even more pious astronomer, who threw away the old figures entirely. This was Julius Schillerus. Since there were the same number of apostles as there were signs of the zodiac, the path through which move the sun, moon and planets, he rather naturally turned these constellations into the twelve apostles. Aries, first of the groups, of course, became St. Peter, leader of the apostles. Pisces became St. Mathias, while Aquarius metamorphosed into St. Jude. Pesagus, which is not a zodiacal group, became St. Gabriel.

Schillerus even went so far as to rename the sun, moon and planets. The sun, obviously, he called Christ; the moon, the Virgin Mary. Mercury was made Elias; Venus, St. John the Baptist; Mars, Joshua; Jupiter, Moses; and Saturn, Adam. Of course, Uranus and Neptune had not been discovered at that time, so there is no way of telling what they might have been called. But these names never came into extensive use, and Schillerus' book, "Coelum Stellatum Christianum," is now extremely rare. These names are now only of historical interest. As a matter of fact, the same could be said of even the old pagan names. The modern astronomer sometimes uses them, but in star lists, he is more likely to refer to them in some such way as this: B. D.—11 degrees 3736, which refers to its number in the Bonn Durchmusterung, one of the most famous of star catalogs.

As for the planets in October, Venus is now visible low in the west for about an hour after sunset. It is moving eastwards from the sun, and so in the coming months it will be conspicuous in the western sky. Saturn is also visible in the western evening sky, for perhaps an hour or so after Venus has set. It is no longer in the favorable position that it has been during the summer. These two planets are not shown on the maps. Jupiter, however, is represented. It is seen low in the eastern sky in the early evening, rising higher as the night progresses, until by midnight it is in the south. It is the brightest thing in this part of the sky, except for the moon, at certain times of the month, and so is not hard to identify. A little later in the night Mars appears, but not until after midnight is it high enough to be easily visible. At 4.45 a. m., it is directly south.

Science News-Letter, October 6, 1928

Religion and Science

General Science

Rev. Frederick C. Grant, D. D., Dean Western Theological Seminary (Episcopal), in the *Chicago Tribune*:

A true religion has nothing to fear from a true science, from a science willing to admit the limited and really abstract range of its investigations, and to recognize that for a full and complete account of existence, other facts, values, and hypotheses are necessary in addition to those with which science ordinarily deals. It is only the fear of new ideas, an intellectual lazy conservatism, or even a covert skepticism, that has terrorized religious minds when confronted with the scientific account of the world. On the other hand, a true science has nothing to fear at the hands of a true religion. Many of the great names in modern scientific history, including the science of today, are those of religious men; and if you call the roll of the real leaders in Christian history, including the present, i. e., the true prophets, the creative minds, the men in whom the genius of the Christian religion is genuinely expressed, how many of them have been or are persecutors or antagonists of science? As Newman Smyth once remarked in a Yale laboratory, "How would Butler, Aquinas and Augustine have reveled in modern scientific research!"

Science News-Letter, October 6, 1928

FIRST GLANCES AT NEW BOOKS

ASTRONOMY AND COSMOGONY—Sir J. H. Jeans—*Cambridge Univ. Press* ($10.25). Only a short time ago King George knighted Prof. Jeans, for the very work that he describes in this book, and probably no similar honor has ever been more deserved. Sir James is one of the few men of science of whom it can be said that when he says something, the scientific world stops to listen. Here he presents, in 420 large octavo pages, the latest fruits of his labors, and as such it represents the last word in the subject indicated by its title. Though it is hardly a book for the beginner, with its frequent mathematical derivations, there is enough non-mathematical material in it to make it welcome to any reader of astronomical works, or to anyone, familiar with modern physical concepts, who wants to know of the latest views on the nature of the cosmos. Numerous tables give admirable summaries of what we know about various classes of objects. The first chapter, "The Astronomical Survey of the Universe," gives an account of the universe and what we know about it, from electrons to nebulae, that has never before been equaled for conciseness and accuracy.

Astronomy
Science News-Letter, October 6, 1928

THE NEW QUANTUM MECHANICS—George Birtwistle—*Cambridge Univ. Press* ($5.50). With physical science developing so rapidly, it is hard even for the physicist to keep abreast of the latest phases of the quantum theory, the Schrödinger wave mechanics or Dirac's important work on the emission and absorbtion of radiation. But here is the last word on it, by one of the leading authorities, a fellow of Pembroke College, Cambridge. Naturally, it bristles with higher mathematics.

Physics
Science News-Letter, October 6, 1928

PRACTICAL COLOR SIMPLIFIED—William J. Miskella—*Finishing Research Lab'y* (Chicago) ($3.50). For anyone who has occasion to use color and color combinations in work or pleasure, this book will prove of interest, for it contains suggestions for all sorts of color work, all based on practical experience. The color charts are especially useful for visualizing the results.

Physics—Art
Science News-Letter, October 6, 1928

BENEATH TROPIC SEAS—William Beebe—*Putnam's* ($3.50). Just the announcement that there's another Beebe book out is enough to cause those who know to reach for their telephones and call up their book-dealers. If there be still any who do not know Beebe's style, this book is a good place to begin the acquaintance; the more so since its frontispiece is one of those lovely other-side-of-the-moon submarine paintings by Zarh Pritchard. *Beneath Tropic Seas* is the popular-presentation side of a long series of marine biological researches, which will eventually bear fruit in more technical monographic form.

Marine Biology
Science News-Letter, October 6, 1928

MARVELS OF SCIENCE—M. K. Wisehart—*Century* ($2.50). This is a most worthy addition to the growing family of books that give the casual reader large but painless doses of information about the scientific foundation of the world he lives in. The miracles of radiovision, X-rays, radium and the rest are all duly set forth; but even more remarkable and unsuspected facts about such commonplace things as glass and paint are what give the book real point and pith.

General Science
Science News-Letter, October 6, 1928

CONTEMPORARY SOCIOLOGICAL THEORIES—Pitirim Sorokin—*Harper* ($4). An excellent antidote for any sociologist, amateur or professional, whose sociology is in danger of becoming one-sided. Prof. Sorokin presents a keen analytical study of the prevailing theories of sociology—mechanistic, bio-social, psychological, anthropo-racial, and the rest. The criticisms and specific facts that he cites in making his points will be particularly useful to the student who finds himself at sea to test the weakness or strength of rival points of view; and his references to about one thousand authorities make the work a valuable informal encyclopedia.

Sociology
Science News-Letter, October 6, 1928

PRE-DEVONIAN PALEOZOIC FORMATIONS OF THE CORDILLERAN PROVINCES OF CANADA—Charles D. Walcott—*Smithsonian Institution.* A posthumous monograph by the late secretary of the Smithsonian Institution.

Geology—Paleontology
Science News-Letter, October 6, 1928

THE LIVING AGE—*New York* ($4 a year). This landmark of the world of literature and current events, a stand-by of our fathers and grandfathers before us, now appears in an entirely new format. The page size has been increased and the magazine is departmentalized and illustrated. The text maintains its accustomed high standard, and the new form will doubtless serve to bring it to many readers, used to standardized magazine shapes, who would not have noticed *The Living Age* in its old-time Cinderella dress.

Current Events
Science News-Letter, October 6, 1928

OPINIONS RENDERED BY THE INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE. Opinions 98 to 104—*Smithsonian Institution.* Of interest to taxonomic zoologists.

Zoology
Science News-Letter, October 6, 1928

NOTES ON THE BUFFALO-HEAD DANCE OF THE THUNDER GENS OF THE FOX INDIANS—*Bulletin* 87, *Bureau of American Ethnology*—Truman Michelson—*Government Printing Office.* Interesting ceremonial rites recorded from trustworthy Indian sources and translated literally. Dr. Michelson presents Indian text on the opposite page to the English and discusses linguistic problems of the Indian text.

Ethnology
Science News-Letter, October 6, 1928

NOTED WITNESSES FOR PSYCHIC OCCURRENCES—Compiled by the Research Officer of the Boston Society for Psychic Research—*Boston Society for Psychic Research.* In many people's lives there occur puzzling experiences that they remember all their days and try to account for. Such experiences reported by 170 famous people, mostly from their own lives, are collected in this volume. Contributions include 20 men of science, such as William James, Hudson Maxim, Linnaeus, and Swedenborg. Lawyers, statesmen, theologians, artists, and soldiers are among other classes of persons who present incidents involving telepathy, apparitions, premonitions, and other phenomena which they generally conclude to be "supernormal." Comments appended to many of the incidents by the Research Officer add very much to the value and interest of the collection.

Psychic Research
Science News-Letter, October 6, 1928

The Open Conspiracy

Sociology

H. G. WELLS in *The Open Conspiracy* (Doubleday, Doran, $2):

The conspiracy that Mr. Wells has opened is that he intends to write two more books before he dies. Since he is now only 63 and has written 59 books since he began in 1895, this is a reasonable expectation from an actuarial standpoint. Particularly since he announces that he will have two more specially qualified collaborators on these works. His "Outline of History" was, it now appears, the first of a trilogy which he designs to serve provisionally as a sort of "bible" for the modern man. The second of the series, now in preparation, will be called "The Science of Life" and the third, only sketched, is "The Conquest of Power."

"The general idea of these writings is to present altogether, first a complete modern world outlook, politically speaking, then the moral data of the new time, and then the forecast of a collective economic policy, in a form accessible to a person of ordinary education. It is the presentation of the threefold basis for a modern ideology, historical, biological and economic. It is a pioneer attempt to get this written down connectedly."

On the basis of these ideas he hopes to have formed heterogeneous groups in all countries, especially of young men and women. But he is much afraid of the common fate of such movements, over-organization and sectarianism, so he does not venture to prescribe forms or programs for the groups though he does lay down the following creed for his disciples:

"1. The complete assertion, practical as well as theoretical, of the provisional nature of existing governments and of our acquiescence to them;

"2. The resolve to minimize by all available means the conflicts of these governments, their militant use of individuals and property and their interferences with the establishment of a world economic system;

"3. The determination to replace private local or national ownership of at least credit, transport and staple production by a responsible world directorate serving the common ends of the race;

"4. The practical recognition of the necessity for world biological controls, for example, of population and disease;

"5. The support of a minimum standard of individual freedom and welfare in the world; and

"6. The supreme duty of subordinating the personal life to the creation of a world directorate capable of these tasks and to the general advancement of human knowledge, capacity and power.

"The admission therewith that our immortality is conditional and lies in the race and not in our individual selves."

Readers of Wells will recognize in this the gradual development of his thought as registered in his former works. They will remember that as late as 1913 he was writing "Little Wars" which was commended as "a vivid and inspiring Kriegspiel" for "boys from twelve years of age to one hundred and fifty." But during the next four years he had too much Kriegspiel so now he is a strong pacifist. It was during the war, too, that he acquired a religion, or at least a realization of the need of something of the sort, as he revealed in "Mr. Britling" and "The Undying Fire." Now he opens his "Open Conspiracy" with a chapter on the "Necessity of Religion to Human Life" while he explains what he means in the second chapter entitled "Subordination of Self the Essence of Religion." In 1917 he wrote that "the Kingdom of God over a world-wide system of republican states is the only possible formula under which we may hope to unify and save mankind." But this was in the book entitled "Italy, France and Britain at War," which, like his book of 1914, "The War That Will End War," is omitted now from the list of his writings.

Wells has always been eagerly searching for utopias. He tried the Fabian Society for a time. Next he came over to America in 1905 to find out why the Oneida Community failed. After the revolution he went to Russia to see if the Soviet might be on the right track. Now he is emphatically antagonistic against all communists, and would exclude them from his "Open Conspirators."

But with all his hopeful seeking his mental compass has turned pretty steady toward its aim and in 1914 the main lines of his trilogy were clearly forecast in one of his most remarkable and least known books, "The World Set Free."

—E. E. SLOSSON.

How the Moon Happened

Geology

R. A. DALY, in *Our Mobile Earth* (Scribner's):

We now turn to the other two suggestions, both involving the problem of the moon's origin.

Two master mathematicians have attacked this problem, and each has published an explanation of our moon. Each explanation assumes the moon to have been at one time a part of the planet, and to have been separated catastrophically when the young planet was rotating very rapidly.

The one solution to the problem is due to Henri Pioncaré. He showed that a liquid planet, rotating at a certain high speed, would take on a pear-shaped figure, which would be stable for that speed. If, however, the rotational velocity were slightly increased, the small end of the pear would break off and, as an independent body, would revolve around the center of gravity that is common to both parts of the original mass. Poincaré suggested this origin for the moon. . . .

The other solution to the lunar problem is that of another prince among the mathematical physicists, George H. Darwin. He also assumed the moon to be a daughter of the earth. According to Darwin, the forces determining the break-up of the original earth were two in number. The more powerful of these was the centrifugal force due to the earth's rapid rotation. The second, less directly powerful but no less essential, was the tidal force which was exerted on the planet by the sun. The tidal force was feeble, but Darwin showed how its effects might have been built up so as to cause the original earth to break into large fragments. The catastrophic accumulation of effects was attributed to the principle called "resonance." Without describing the mechanism of resonance, I shall here merely note its practical effect, according to Darwin. The mechanism worked to the point of producing a tidal wave in the molten earth, which was of the order of 1,000 kilometers in height. When the leaping tide had reached such a height, its acceleration was enough to cause one or more large pieces of the planet to jump clear away from the main body. The matter, thus propelled out of the original earth, had its own center of gravity. Around that center the ejected matter pulled itself together by its own gravitation, into a nearly spherical form and began an independent career as our moon.

CLASSICS OF SCIENCE: Campaign Against Yellow Fever

Hygiene—Public Health

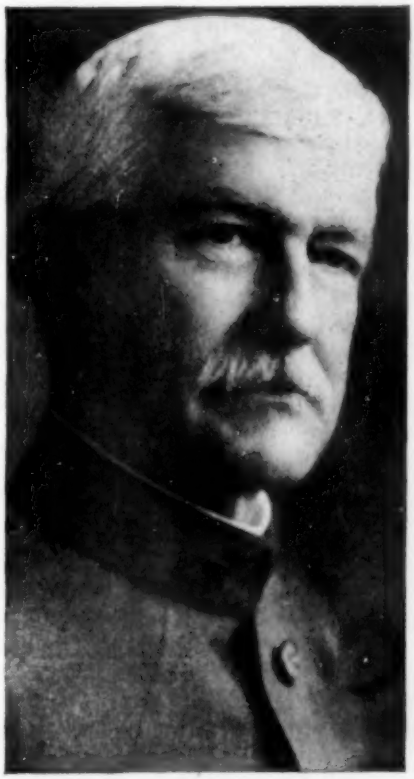
October 3 was the 74th anniversary of the birth of Gorgas, whose own directions for ridding a community of yellow fever are used as the Science Classic this week.

A Few General Directions with regard to Destroying Mosquitoes, particularly the Yellow Fever Mosquito. By W. C. Gorgas, Colonel, Medical Corps, U. S. Army, Washington: Government Printing Office, 1904.

Before the year 1900 it was universally believed that yellow fever was carried from person to person and spread generally by a germ, which up to the time had not been discovered. The germ was supposed to travel from person to person by contact with those sick of the disease, or by means of clothing or other articles which had been near the sick, and its development was believed to be greatly favored by all conditions which increased filth. There were a good many facts in the spread of the disease which were difficult to account for under this supposition, but nevertheless it was the best explanation possible, and, as I said, was almost universally accepted, both by physicians and people generally. . . .

At this time the military authorities had had entire control of Habana for about two years. An army doctor had been placed in charge of the health department and given the means and power to do what he thought most likely to free the city from yellow fever. Yellow fever in Habana was a disease like consumption in Galveston or New Orleans—always there, and always one of the principal causes of death in the city. And this had been the state of affairs as long as anything had been known with any accuracy, either about yellow fever or about the health conditions of Habana; and these things were pretty accurately known for more than a hundred years immediately preceding the time I refer to. When we organized our health department, we believed, as did everybody else, that yellow fever was caused by filth, dirt, and general insanitary conditions, so we went to work doing our very best to correct these conditions. With these efforts Habana very rapidly became a healthy city, as much so as many of our large cities in the United States, but yellow fever did not seem to be affected.

The second year of our control yellow fever was very severe in Habana, but did not attack the native



SURG.-GEN. WILLIAM CRAWFORD GORGAS, one of the world's greatest sanitary geniuses

Cuban because he was generally acclimated. Only the foreigner, therefore, was subject to the disease. Durthe year 1900 many of our prominent American civilians and military officials died of the disease, and the very cleanest and best parts of the city and the people who lived best and took the best care of themselves were most affected. When the army board published their discovery to the world the health department of Habana recognized that it and all the rest of the world had been on the wrong track with regard to yellow fever, and they determined to change their methods and attack the mosquito as the cause of the disease.

They had been convinced by the work of the army board that a human being could only get yellow fever by being bitten by a particular kind of mosquito—the stegomyia—which had previously bitten a man suffering from yellow fever. They therefore arranged that as soon as a man sickened with yellow fever, employees from the department went to the house and screened it with wire netting, so that those mosquitoes that were in the house could not get out and those outside could not get in. A smudge was then made of sulphur, tobacco, or insect powder, as best suited to the circumstances, in the affected house, and in all those immediately around it, with the intention of killing all mosquitoes present. By this method it was hoped that both the mosquitoes that had bitten the man and caused the disease would be killed, and also those that had bitten the man after he was taken sick, and had thus become themselves infected and able to spread the disease. For the purpose of doing this screening a building was arranged much like a fire station in one of our cities, where wagons, wire screens, carpenters, and men with material for making smudge, were always kept on duty, who proceeded at once to the place where a yellow fever case was reported to exist.

Wigglers Need Air

This method was very successful in its results. After its adoption very few cases occurred where the disease spread from the person infected to others in the neighborhood. It was also determined to destroy as many as possible of the yellow fever mosquitoes in the city. It was known that the female mosquito had to have water on which to lay her eggs, and that these eggs could not hatch without water; that this water had to be very quiet and well protected for the hatching process to take place; that the eggs took about three days to hatch; that after hatching the insect had to live the life of a fish in this water for five or six days. During this fish stage they are known as larvae, and are well known to everybody in the South, for they are nothing but the common wigglers always found in standing rain water during the summer months. Now, while in this wiggler stage the insect has to have air, and for this purpose must every little while come to the surface. At the end of five or six days the wiggler changes into the full-grown mosquito.

It is known that this particular species of mosquito—the stegomyia, or the yellow fever mosquito—lives and breeds almost altogether in houses and in their immediate neighborhood, and (*Turn to next page*)

Campaign Against Yellow Fever—*Continued*

does not leave the house for any great distance. With this knowledge of its life history, the department found it easiest to destroy the mosquito in its wiggler stage, and the most useful means in this direction they found to be the doing away with all the little deposits of water in and near inhabited houses, which the wiggler must have in order to develop into the mosquito. The methods herein described were not settled upon, as might appear from this account, all at once and at the beginning, but many other methods of waging war against the mosquito were tried, found impracticable, and dropped.

Cover Water Cisterns

With the object of doing away with the breeding places of the yellow fever wiggler all the houses and yards of Habana were carefully examined and all tin cans, empty bottles, and trash of the same kind, which were generally found filled with rain water, and full of yellow fever mosquito larvae were carefully carted off. Then the necessary openings in all cisterns were covered with mosquito netting, so that the mosquitoes could not get in to lay their eggs. Among the poorer people, who had only barrels and other similar receptacles for rain water (and in Habana every family had something of this kind), the health department arranged these necessary receptacles for them by placing a wooden cover on the barrel, leaving a hole in the center of this cover for the entrance of water, and covering the hole with wire netting, so that mosquitoes could not get in. To enable them to draw off the water without opening the barrel a cheap wooden spigot was placed in the lower part.

Now from the peculiarity of the wiggler, that he has to come to the surface of the water every few seconds to get air, if we put anything on the surface of the water that prevents him getting this air, he drowns just as certainly as a man would who is kept under the water. Ordinarily kerosene oil, a tablespoonful or two to a cistern, spreads over the surface of the water and kills the wiggler in this way. He can not break through the scum of oil to get air. But oil very rapidly evaporates and has frequently to be renewed. So oil was only used in Habana where no other method was successful. The privy pits in all the houses there were in the center of the court, covered generally with heavy flagstone. These pits not being in general accessible to the inspectors had to be treated with oil. Once a month, a couple of ounces of oil were poured into the pipes leading to the pits.

To insure that these methods and ordinances were carried out, the city was divided into districts of about a thousand houses each, so that an inspector would get over each district in the course of a month, inspecting at the rate of about thirty houses a day. This inspector had with him two men who used the oil as above described. He had with him printed blanks on which he entered the condition of the premises as to wigglers. These reports were turned in every night to the office of the health department and were consolidated from day to day. At the end of the month we could therefore tell the condition of Habana as to wigglers. At the first report on this subject (I think in March 1901), we found that we had in Habana in the neighborhood of 26,000 different water deposits which contained wigglers, most of them of the yellow-fever variety.

Wiggler Breeders Fined

After once going over the city and carefully explaining to the people the dangers of allowing wigglers on their premises, and after having fixed up for the poor all the water barrels which they were obliged to keep for holding their rain water, the mayor of the city issued an ordinance stating that anybody who bred wigglers on his premises would be fined $10. These two methods of destroying yellow fever mosquitoes, namely, that of killing the grown mosquito in the neighborhood of every yellow-fever patient with a smudge and of looking after the wigglers in all rain water deposits about the house, were steadily enforced during the year 1901. The results were better than we had dared to hope. Few cases occurred in which yellow fever spread from a case cared for in this way. Yellow fever rapidly decreased, and on September 28, 1901, the last case of yellow fever occurred in Habana, and since that time—now more than two years—not a single new case has developed in the city.

There were still, of course, a great many yellow-fever mosquitoes in Havana, but these methods of destroying the wigglers had greatly decreased the numbers of mosquitoes. The report of January, 1902, after about ten months of this mosquito work, showed that within the city limits less than 300 premises had wigglers upon them. This I think a very fair measure of the results accomplished by one year's work, namely, that the number of deposits containing wigglers had been decreased from about 26,000 to about 300.

William Crawford Gorgas was born in Mobile, Ala., on October 3, 1854. During the Civil War he was going to school in Richmond and already hoping and planning to have a military career. However these plans were opposed by the family and he studied medicine, taking his degree from the Bellvue Hospital Medical College in 1879. The following year he gratified his military ambitions by entering the Medical Department of the U. S. Army. The younger lieutenant was sent to Ft. Brown, near Brownsville, Texas, where a yellow fever epidemic was raging, to take care of the civilian population. One of his patients, Miss Marie Cook Doughty, afterwards became his wife. Gorgas contracted yellow fever himself at this time, and the fact that he and Mrs. Gorgas were both thus immune to the disease was helpful when his duties took him to Havana and Panama. Recognition of his practical knowledge of yellow fever transmission resulted in his being appointed chief sanitary officer of Havana in 1898. Gorgas was quick to recognize the value of the work done by the Army board under Walter Reed, in implicating the mosquito as transmitter of yellow fever. "If it is the mosquito," said Gorgas, "I am going to get rid of the mosquito." He did, using the methods in the preceding discussion. When the project of the Panama Canal came up, the chief difficulty was known to be the prevalence of yellow fever and malaria which made the place practically uninhabitable. President Roosevelt sent Gorgas down there to clean it up for the engineers who would follow to construct the canal. In 1915 Gorgas and his associates in the Isthmian Canal Commission received a vote of thanks from Congress for their distinguished service in this connection. This recognition of sanitary achievement by the State is one of the few such in all history since Hippocrates was awarded a civic crown by the citizens of Athens for averting a pestilence from that city. During the World War he served with great distinction, directing the sanitation and hygienic measures among the troops at training camps all over the country. After the war, he continued his work toward yellow fever eradication. In 1920 he sailed for England en route to Africa, where he was to investigate yellow fever conditions there. He became ill in London and died there July 4, 1920. Funeral services were held in Westminster Abbey, and his body now rests in Arlington National Cemetery. During his illness in London, the King of England visited his bedside to confer on him the highest honor that it is possible for the King to bestow on anyone not a British subject.